by that control and display symbol. There are several different variations for recording invalid symbols and many different variations in placing the invalid symbols, which result in the invalid data appearing in various subcode channels and in different data fields within those subcode channels. Several of these variations appear as non-limiting examples below, using the Q-channel as a subcode channel for the invalid data to appear. There are several different ways to determine the validity of Q-channel data, depending on the nature of the invalid data, as described below.

If the invalid data is implemented with one or more incorrect symbols, such as those depicted in FIG. **4**, as described previously, then a single reading operation suffices to make the determination. FIG. **3** illustrates the contents of the Q-channel when valid, correct symbols are written as described previously, whereas FIG. **5** illustrates the contents of the Q-channel when incorrect symbols are written as described previously. Accordingly, FIG. **11** shows the steps of a method of authentication according to the present invention for using incorrect symbols in the Q-channel. The first step is to record correct Q-channel data in a first location ('A') of all original Compact Discs to be authenticated in a first recording step **1102**. For example, this data could be the data **304** illustrated in FIG. **3**, where location 'A'includes 75 contiguous sectors of information extending from an absolute time location on the track of 03 minutes 40 seconds 00 frames to an absolute time location on the track of 03 minutes 40 seconds 74 frames, and containing the correct absolute time location information as specified by the standards. The second step is to record incorrect Q-channel data in a second location ('B') of all original Compact Discs to be authenticated in a second recording step **1104**. For example, this data could be the data **506** illustrated in FIG. **5**, where location 'B' includes 75 contiguous sectors of information extending from an absolute time location on the track of 03 minutes 41 seconds 00 frames to an absolute time location on the track of 03 minutes 41 seconds 74 frames, but containing incorrect absolute time location information which erroneously indicates these locations to be from an absolute time location on the track of 03 minutes 40 seconds 00 frames to an absolute time location on the track of 03 minutes 40 seconds 74 frames. Note that this writing of incorrect Q-channel data in location 'B' includes the writing of a new CRC in a writing operation **424** (FIG. **4**) corresponding to the incorrect Q-channel data, as previously described. The third step is to record correct Q-channel data in a third location ('C') of all original Compact Discs to be authenticated in a third recording step **1106**. For example, this data could be the data **308** illustrated in FIG. **3**, where location 'C' includes 75 contiguous sectors of information extending from an absolute time location on the track of 03 minutes 42 seconds 00 frames to an absolute time location on the track of 03 minutes 42 seconds 74 frames, and containing the correct absolute time location information as specified by the standards. Note that in this example, location 'A', location 'B', and location 'C' encompass **225** contiguous sectors. The next step is to read locations 'A', 'B', and 'C' of an undetermined instance of the Compact Disc in a reading operation **1108**. Next, in a decision point **1110**, the Q-channel data in location 'B' is compared against that of location 'A' and location 'C'. In this example, the correct value of the Q-channel data in location 'B' is shown as data **306** of FIG. **3** (indicating these locations to be from an absolute time location on the track of 03 minutes 41 seconds 00 frames to an absolute time location on the track of 03 minutes 41 seconds 74 frames). If the Q-channel data of location 'B' follows correctly after that of location 'A' and correctly before that of location 'C', then location 'B' has correct Q-channel data. Otherwise, location 'B' has incorrect Q-channel data. In one embodiment of the present invention, the correctness of the Q-channel data of location 'B' can be determined by a comparison with that of location 'A' alone; in another embodiment of the present invention, the correctness of the Q-channel data of location 'B' can be determined by a comparison with that of location 'C' alone; in still another embodiment of the present invention, the correctness of the Q-channel data of location 'B' can be determined by a comparison with that of that of both location 'A' and location 'C' together. In yet another embodiment of the present invention, the correctness of the Q-channel data of location 'B' can be determined without any comparison by scanning the Compact Disc for Q-channel data that indicates an absolute time location on the track of anywhere from 03 minutes 41 seconds 00 frames to an absolute time location on the track of 03 minutes 41 seconds 74 frames. If such a time is present in any sector, there is necessarily correct data in location 'B'. Otherwise, if such a time is not present anywhere on the Compact Disc, then there exists a location 'B' whose Q-channel data is incorrect. By whichever means is most convenient, if decision point **1110** results in a finding that the Q-channel data of location 'B' is incorrect, then in an output step **1112** the undetermined instance of the Compact Disc is determined to be an original Compact Disc. Otherwise, in an output step **1114** the undetermined instance of the Compact Disc is determined to be an unauthorized copy.

The use of incorrect symbols as described above has the property that the validity of Q-channel data can be determined by a single reading operation possibly involving only comparisons with other Q-channel data. It is also possible to achieve greater security in the authentication process by utilizing ambiguous symbols, but when doing so, it is necessary to make multiple reading operations of the same Q-channel data, and to be able to compare the Q-channel location information with the sector address information in the sector headers. Therefore, the method according to the present invention for authenticating a Compact Disc using ambiguous symbols involves multiple reading operations, as illustrated in FIG. **12**. In order to determine if a symbol is an ambiguous symbol, it is necessary to make multiple readings of that symbol's data values and compare the data values read in the multiple readings to see if the data values are the same or different. If different data values are read, the symbol is an ambiguous symbol. If a sufficient number of readings are made and all the data values are the same, the symbol can be statistically considered not to be an ambiguous symbol. Following is a description of how this can be done in terms of reading Q-channel data.

In a preferred embodiment of the present invention, in a recording step **1202**, ambiguous data is recorded in the Q-channel in a selected location 'B' of all original Compact Discs to be authenticated. Recall that the ambiguous symbols to be recorded as control and display symbols must put ambiguous data in the Q-channel, and should be selected as described herein and illustrated in FIG. **7**. The recording operation also involves recording a new CRC in a recording operation **624** as illustrated in FIG. **6**. Next, in an offset calibration step **1204**, a sector offset **1206** is determined. A step **1208** sets a loop reading limit **1210** and initializes a loop counter **1211**. Then, in a step **1212**, a first reading of Q-channel data in location 'B' of an undetermined instance of the Compact Disc results in a sector address **1214** and Q-channel data **1216**. Having read location 'B' in a first reading, it is necessary to read location 'B' again a number